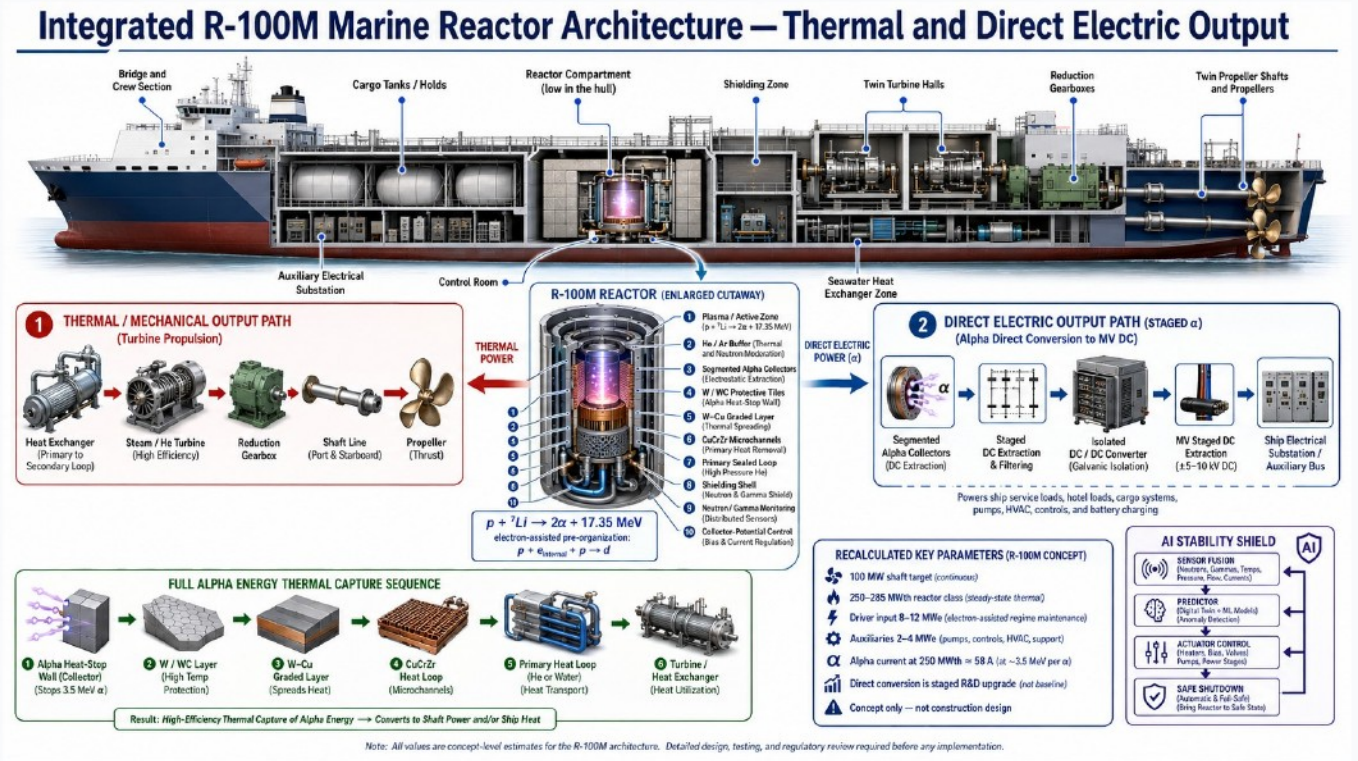
OUXSPACE R-100M Integrated Marine Reactor Presentation

Complete 15-slide synthesis: main architecture, alpha direct electricity, thermal capture, AI shield, ship cutaway and electrical substation output


Integrated R-100M Marine Reactor Architecture — Thermal and Direct Electric Output
Bridge and Crew Section
Cargo Tanks / Holds
Reactor Compartment (low in the hull)
Shielding Zone
Twin Turbine Halls
Reduction Gearboxes
Twin Propeller Shafts and Propellers
Auxiliary Electrical Substation
Control Room
Seawater Heat Exchanger Zone
1 THERMAL / MECHANICAL OUTPUT PATH
(Turbine Propulsion)
Heat Exchanger (Primary to Secondary Loop)
Steam / He Turbine (High Efficiency)
Reduction Gearbox
Shaft Line (Port & Starboard)
Propeller (Thrust)
THERMAL POWER
R-100M REACTOR (ENLARGED CUTAWAY)
Plasma / Active Zone
He / Ar Buffer (Thermal and Neutron Moderation)
Segmented Alpha Collectors (Electrostatic Extraction)
W / WC Protective Tiles (Alpha Heat-Stop Wall)
W–Cu Graded Layer (Thermal Spreading)
CuCrZr Microchannels (Primary Heat Removal)
Primary Sealed Loop (High Pressure He)
Shielding Shell (Neutron & Gamma Shield)
Neutron / Gamma Monitoring (Distributed Sensors)
Collector-Potential Control (Bias & Current Regulation)
p + 7Li → 2α + 17.35 MeV
electron-assisted pre-organization:
p + e⁻internal + p → d
DIRECT ELECTRIC POWER (α)
2 DIRECT ELECTRIC OUTPUT PATH (STAGED α)
(Alpha Direct Conversion to MV DC)
Segmented Alpha Collectors (DC Extraction)
Staged DC Extraction & Filtering
Isolated DC / DC Converter (Galvanic Isolation)
MV Staged DC Extraction (±5–10 kV DC)
Ship Electrical Substation / Auxiliary Bus
Powers ship service loads, hotel loads, cargo systems, pumps, HVAC, controls, and battery charging
FULL ALPHA ENERGY THERMAL CAPTURE SEQUENCE
1 Alpha Heat-Stop Wall (Collector) (Stops 3.5 MeV α)
2 W / WC Layer (High Temp Protection)
3 W–Cu Graded Layer (Spreads Heat)
4 CuCrZr Heat Loop (Microchannels)
5 Primary Heat Loop (He or Water) (Heat Transport)
6 Turbine / Heat Exchanger (Heat Utilization)
Result: High-Efficiency Thermal Capture of Alpha Energy → Converts to Shaft Power and/or Ship Heat
RECALCULATED KEY PARAMETERS (R-100M CONCEPT)
100 MW shaft target (continuous)
250–285 MWth reactor class (steady-state thermal)
Driver input 8–12 MWe (electron-assisted regime maintenance)
Auxiliaries 2–4 MWe (pumps, controls, HVAC, support)
Alpha current at 250 MWth ≈ 58 A (at ~3.5 MeV per α)
Direct conversion is staged R&D upgrade (not baseline)
Concept only — not construction design
AI STABILITY SHIELD
AI
SENSOR FUSION (Neutrons, Gammas, Temps, Pressure, Flow, Currents)
PREDICTOR (Digital Twin + ML Models) (Anomaly Detection)
ACTUATOR CONTROL (Heaters, Bias, Valves) Pumps, Power Stages)
SAFE SHUTDOWN (Automatic & Fail-Safe) (Bring Reactor to Safe State)
Note: All values are concept-level estimates for the R-100M architecture. Detailed design, testing, and regulatory review required before any implementation.

Scope

Unifies the previous marine reactor deck, alpha-direct-conversion appendix, AI stability annex and the new whole-ship output schematic.

Claim discipline

High-level R&D concept only. Low-neutron target, not zero-radiation; all nuclear claims require calorimetry and radiation validation.

Core reaction

$p + {}^{7}Li \rightarrow 2\alpha + 17.35$ MeV. Charged alpha products are captured in 4π geometry as heat and, later, staged DC.

Outputs

Baseline: heat → turbine → shaft. R&D upgrade: alpha direct electric conversion → isolated DC → ship substation.

1. What was integrated from the previous decks

All previous presentation images are preserved through visual source galleries, with the main diagrams reused as large explanatory figures.

Main R-100M deck

Direct turbine → gearbox → shaft, p–e–p pre-organization, p–Li branch, wall stack, marine loops, safety gates.

Alpha appendix

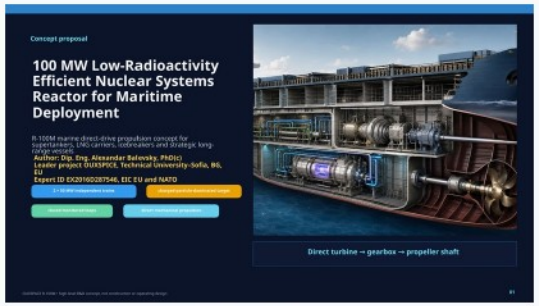
Alpha charge current, direct conversion options, MV staged collectors, neutralization and Li-7 supply.

AI annex

Sensor fusion, predictor layer, actuator logic, deterministic safety kernel and safe shutdown.

New integrated drawings

Whole-ship compartment cutaway and final reactor → turbine + electric substation output schematic.


Concept proposal
100 MW Low-Radioactivity Efficient Nuclear Systems Reactor for Maritime Deployment
Direct turbine → gearbox → propeller shaft

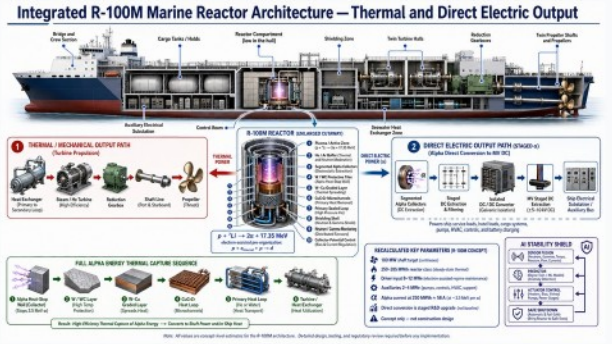
Main deck title / R-100M concept

Appendix A — Alpha Charge, Direct Conversion & Li-7 Fuel Supply
Why this appendix is required
Primary branch
p + 7Li → 2α + 17.35 MeV

Alpha direct conversion appendix

ANNEX II
AI Real-Time Stability Shield for a 100 MW Fusion Reactor Concept
Core message: AI does not create the fusion mechanism; it keeps the reactor inside a safe stability basin.

AI Real-Time Stability Shield annex



New whole-ship integrated schematic

- Baseline output remains thermal/mechanical: alpha energy is stopped locally and converted through heat loops, turbines, gearboxes and propeller shafts.
- Direct alpha electricity is added as a staged R&D branch: segmented high-voltage collectors → isolated DC/DC → auxiliary ship bus.
- The final slide shows the complete compartment layout, reactor cutaway, turbine halls, electrical substation and protective thermal capture sequence.

2. Visual gallery — Main R-100M presentation

Full visual contact sheet from the source deck: framing, reaction logic, marine architecture, shaft drive, thermal loops and safety gates.

Visual gallery — Main R-100M deck with Appendix 2

Slide 1

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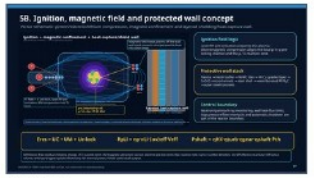

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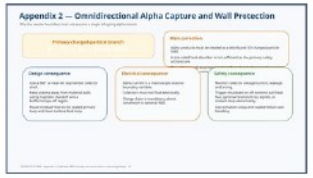

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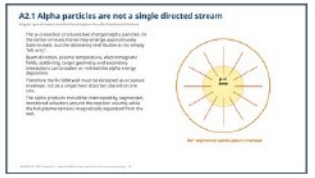
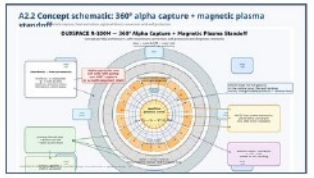


Slide 19



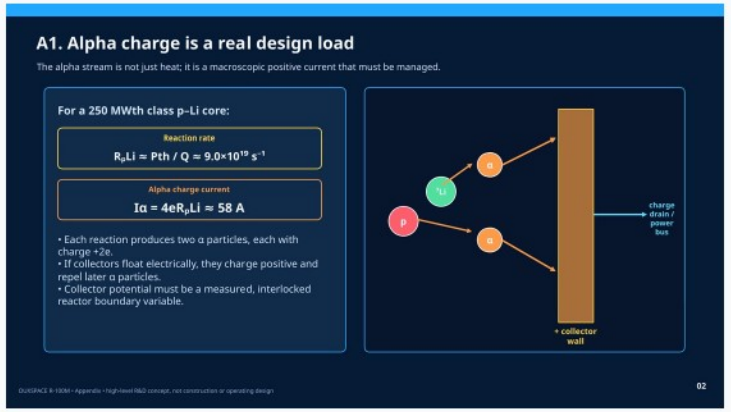
Slide 20

Slide 21

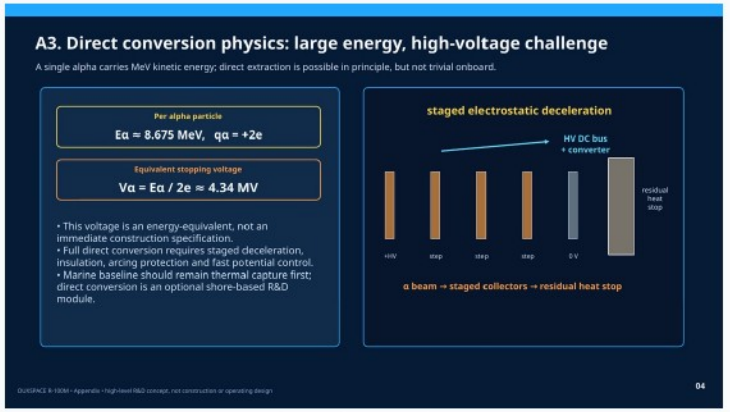
- The main deck frames the system as a measured low-radioactivity R&D programme, not a certified reactor product.
- Core chain: laser/RF pre-ionization → EM compression → $H^+/^7Li$ feed → alpha heat capture → sealed cartridge handling.
- Marine architecture: sealed primary loop, clean intermediate loop, turbine drive, gearbox and two independent 50 MW shaft trains.
- Safety discipline: calorimetry, neutron/gamma monitoring, activation assays, wall heat-flux limits and class review.

3. Visual gallery — Alpha direct conversion appendix

All alpha-energy, charge-management, direct-conversion and Li-7 logistics diagrams are preserved in one visual source page.


A1. Alpha charge is a real design load
The alpha stream is not just heat; it is a macroscopic positive current that must be managed.
For a 250 MWth class p–Li core:
Reaction rate
$R_pLi \approx Pth / Q \approx 9.0\times10^{19}\ s^{-1}$
Alpha charge current
$I\alpha = 4eR_pLi \approx 58\ A$
• Each reaction produces two α particles, each with charge +2e.
• If collectors float electrically, they charge positive and repel later α particles.
• Collector potential must be a measured, interlocked reactor boundary variable.
p
⁷Li
α
α
charge drain / power bus
+ collector wall
02

Alpha charge is a real design load


A3. Direct conversion physics: large energy, high-voltage challenge
A single alpha carries MeV kinetic energy; direct extraction is possible in principle, but not trivial onboard.
Per alpha particle
$E\alpha \approx 8.675\ MeV,\ q\alpha = +2e$
Equivalent stopping voltage
$V\alpha = E\alpha / 2e \approx 4.34\ MV$
• This voltage is an energy-equivalent, not an immediate construction specification.
• Full direct conversion requires staged deceleration, insulation, arcing protection and fast potential control.
• Marine baseline should remain thermal capture first; direct conversion is an optional shore-based R&D module.
staged electrostatic deceleration
HV DC bus + converter
+HV
step
step
step
0 V
residual heat stop
α beam → staged collectors → residual heat stop
04

Equivalent stopping voltage and staged conversion

- A 250 MWth p–Li core implies reaction-rate and alpha-current scales large enough to make collector potential a reactor boundary variable.
- Thermal capture plus controlled charge drainage is the baseline demonstrator.
- Electrostatic direct conversion requires MV-class segmented collectors and arc/leakage protection.
- Hybrid direct + thermal capture is the preferred long-term architecture if staged direct conversion is experimentally stable.

4. Visual gallery — AI Real-Time Stability Shield annex

The AI layer is treated as a mandatory safety/control layer, not as the physical energy mechanism.

Visual gallery — AI real-time stability shield annex

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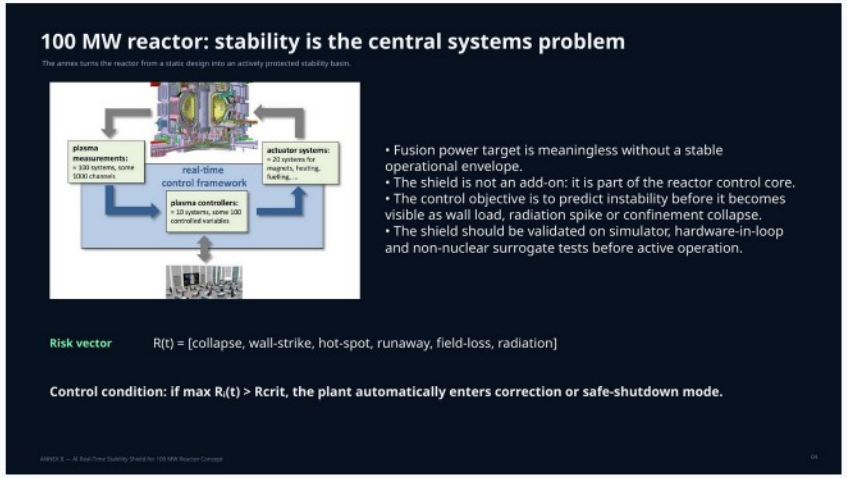
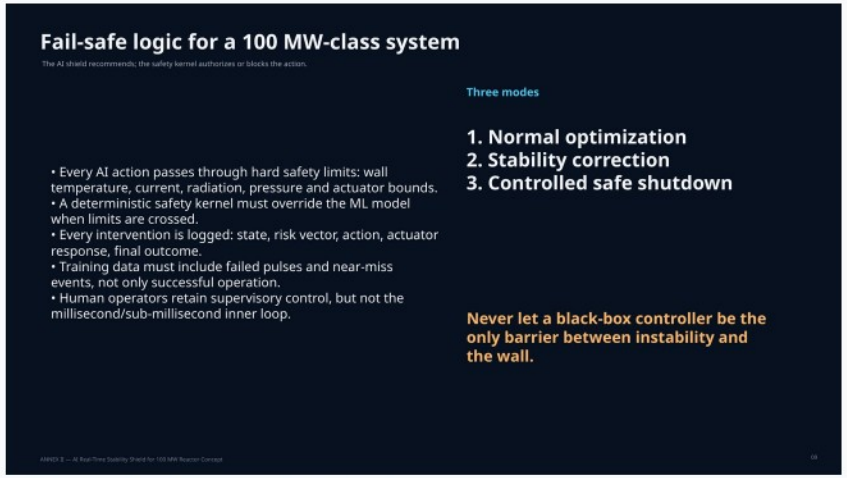
- The 100 MW concept must be presented as a cyber-physical plant: sensors, predictor, actuator authority and verified shutdown logic.
- Never let a black-box model be the only barrier between instability and the wall.


100 MW reactor: stability is the central systems problem
plasma measurements:
real-time control framework
actuator systems:
plasma controllers:
• Fusion power target is meaningless without a stable operational envelope.
• The shield is not an add-on: it is part of the reactor control core.
• The control objective is to predict instability before it becomes visible as wall load, radiation spike or confinement collapse.
• The shield should be validated on simulator, hardware-in-loop and non-nuclear surrogate tests before active operation.
Risk vector
R(t) = [collapse, wall-strike, hot-spot, runaway, field-loss, radiation]
Control condition: if max Ri(t) > Rcrit, the plant automatically enters correction or safe-shutdown mode.

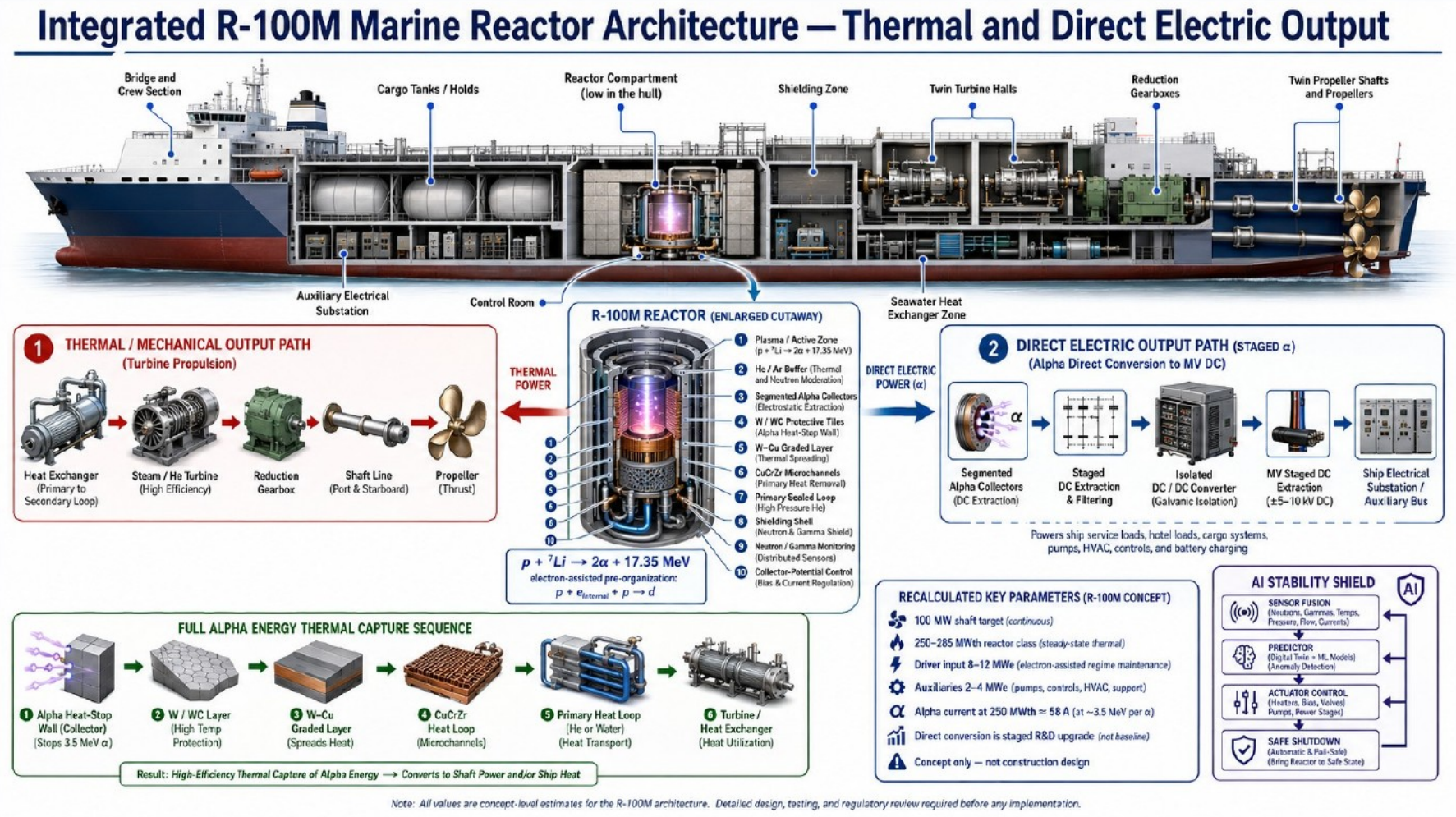
AI architecture: sensor fusion → risk vector → action


Fail-safe logic for a 100 MW-class system
The AI shield recommends; the safety kernel authorizes or blocks the action.
Three modes
1. Normal optimization
2. Stability correction
3. Controlled safe shutdown
• Every AI action passes through hard safety limits: wall temperature, current, radiation, pressure and actuator bounds.
• A deterministic safety kernel must override the ML model when limits are crossed.
• Every intervention is logged: state, risk vector, action, actuator response, final outcome.
• Training data must include failed pulses and near-miss events, not only successful operation.
• Human operators retain supervisory control, but not the millisecond/sub-millisecond inner loop.
Never let a black-box controller be the only barrier between instability and the wall.

Fail-safe logic and deterministic safety kernel

5. Whole-ship compartment view

The new drawing shows the vessel section, internal compartments, reactor position low in the hull, turbine halls, gearboxes, twin shafts and auxiliary substation.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1 Plasma / Active Zone
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7 Primary Sealed Loop (High Pressure He)
8 Shielding Shell (Neutron & Gamma Shield)
9 Neutron / Gamma Monitoring (Distributed Sensors)
10 Collector-Potential Control (Bias & Current Regulation)
p + 7Li → 2α + 17.35 MeV
electron-assisted pre-organization:
p + e_external + p → d
DIRECT ELECTRIC POWER (α)
2 DIRECT ELECTRIC OUTPUT PATH (STAGED α) (Alpha Direct Conversion to MV DC)
Segmented Alpha Collectors (DC Extraction)
Staged DC Extraction & Filtering
Isolated DC / DC Converter (Galvanic Isolation)
MV Staged DC Extraction (±5–10 kV DC)
Ship Electrical Substation / Auxiliary Bus
Powers ship service loads, hotel loads, cargo systems, pumps, HVAC, controls, and battery charging
FULL ALPHA ENERGY THERMAL CAPTURE SEQUENCE
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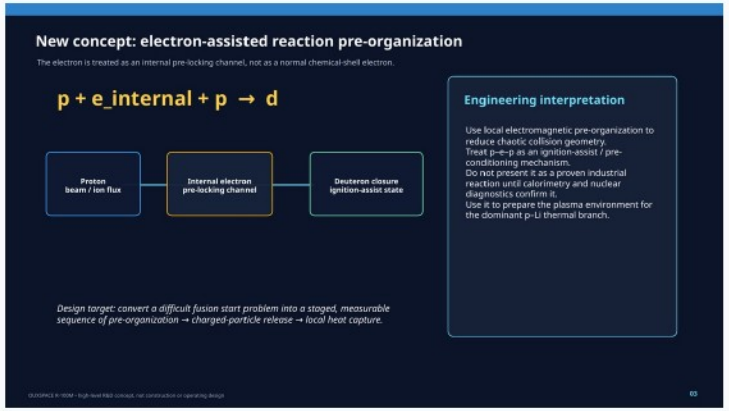
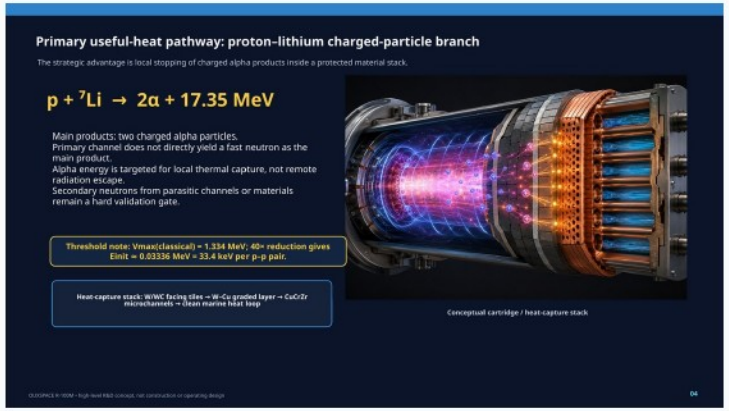
Result: High-Efficiency Thermal Capture of Alpha Energy → Converts to Shaft Power and/or Ship Heat
RECALCULATED KEY PARAMETERS (R-100M CONCEPT)
100 MW shaft target (continuous)
250–285 MWth reactor class (steady-state thermal)
Driver input 8–12 MWe (electron-assisted regime maintenance)
Auxiliaries 2–4 MWe (pumps, controls, HVAC, support)
Alpha current at 250 MWth ≈ 58 A (at ~3.5 MeV per α)
Direct conversion is staged R&D upgrade (not baseline)
Concept only — not construction design
AI STABILITY SHIELD
SENSOR FUSION (Neutrons, Gammas, Temps, Pressure, Flow, Currents)
PREDICTOR (Digital Twin + ML Models) (Anomaly Detection)
ACTUATOR CONTROL (Heaters, Bias, Valves) Pumps, Power Stages)
SAFE SHUTDOWN (Automatic & Fail-Safe) (Bring Reactor to Safe State)
Note: All values are concept-level estimates for the R-100M architecture. Detailed design, testing, and regulatory review required before any implementation.

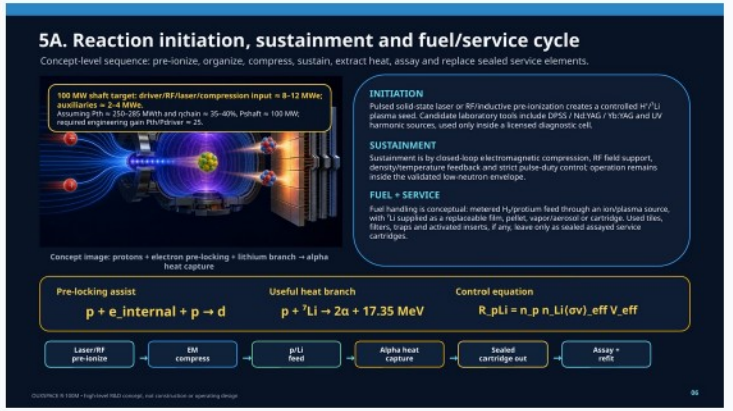
• Reactor compartment is placed low in the hull; turbine halls and gearboxes remain in the propulsion section; auxiliary electrical substation is separated from the active core boundary.

6. Reaction initiation and useful alpha branch

The presentation separates the hypothetical ignition-assist pre-organization from the useful charged-particle heat branch.


New concept: electron-assisted reaction pre-organization
The electron is treated as an internal pre-locking channel, not as a normal chemical-shell electron.
p + e_internal + p → d
Proton beam / ion flux
Internal electron pre-locking channel
Deuteron closure ignition-assist state
Engineering interpretation
Use local electromagnetic pre-organization to reduce chaotic collision geometry.
Treat p–e–p as an ignition-assist / pre-conditioning mechanism.
Do not present it as a proven industrial reaction until calorimetry and nuclear diagnostics confirm it.
Use it to prepare the plasma environment for the dominant p–Li thermal branch.
Design target: convert a difficult fusion start problem into a staged, measurable sequence of pre-organization → charged-particle release → local heat capture.


Primary useful-heat pathway: proton–lithium charged-particle branch
The strategic advantage is local stopping of charged alpha products inside a protected material stack.
p + 7Li → 2α + 17.35 MeV
Main products: two charged alpha particles.
Primary channel does not directly yield a fast neutron as the main product.
Alpha energy is targeted for local thermal capture, not remote radiation escape.
Secondary neutrons from parasitic channels or materials remain a hard validation gate.
Threshold note: Vmax(classical) = 1.334 MeV; 40× reduction gives Einit = 0.03336 MeV = 33.4 keV per p–p pair.
Heat-capture stack: W/WC facing tiles → W–Cu graded layer → CuCrZr microchannels → clean marine heat loop
Conceptual cartridge / heat-capture stack


5A. Reaction initiation, sustainment and fuel/service cycle
Concept-level sequence: pre-ionize, organize, compress, sustain, extract heat, assay and replace sealed service elements.
100 MW shaft target: driver/RF/laser/compression input ≈ 8–12 MWe; auxiliaries ≈ 2–4 MWe.
Assuming Pth = 250–285 MWth and ηchain ≈ 35–40%, Pshaft ≈ 100 MW; required engineering gain Pfu/Pdriver ≈ 25.
Concept image: protons + electron pre-locking + lithium branch → alpha heat capture
INITIATION
Pulsed solid-state laser or RF/inductive pre-ionization creates a controlled H+/7Li plasma seed. Candidate laboratory tools include DPSS / Nd:YAG / Yb:YAG and UV harmonic sources, used only inside a licensed diagnostic cell.
SUSTAINMENT
Sustainment is by closed-loop electromagnetic compression, RF field support, density/temperature feedback and strict pulse-duty control; operation remains inside the validated low-neutron envelope.
FUEL + SERVICE
Fuel handling is conceptual: metered H2/protium feed through an ion/plasma source, with 7Li supplied as a replaceable film, pellet, vapor/aerosol or cartridge. Used tiles, filters, traps and activated inserts, if any, leave only as sealed assayed service cartridges.
Pre-locking assist
p + e_internal + p → d
Useful heat branch
p + 7Li → 2α + 17.35 MeV
Control equation
R_pLi = n_p n_Li⟨σv⟩_eff V_eff
Laser/RF pre-ionize
EM compress
p/Li feed
Alpha heat capture
Sealed cartridge out
Assay + refit

Ignition-assist hypothesis

p + e_internal + p → d is framed only as a pre-conditioning / pre-locking channel. It is not claimed as proven industrial physics before validation.

Useful heat branch

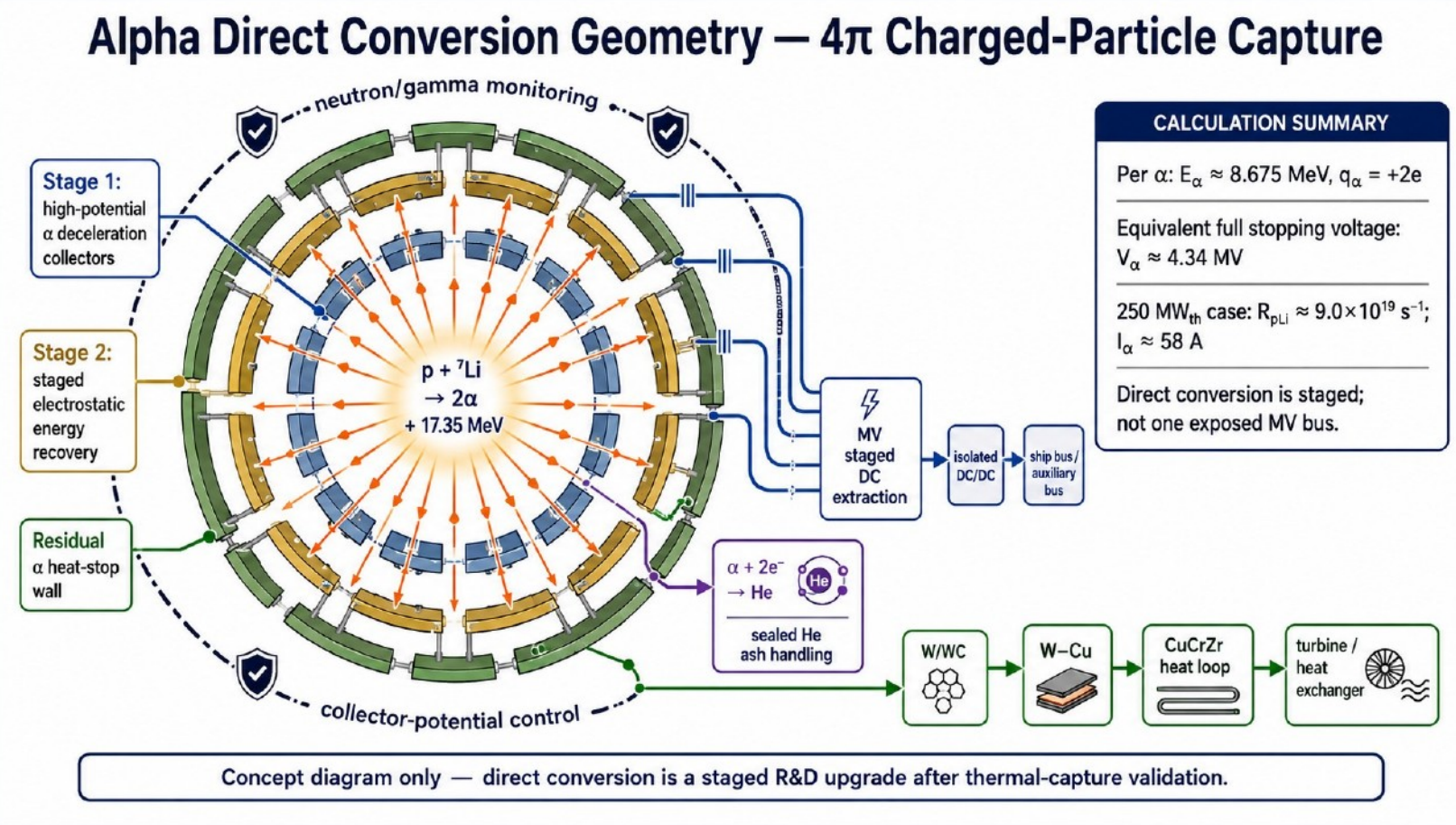
p + ^{7}Li → 2α + 17.35 MeV. The desired products are two charged alpha particles, enabling local stopping and low-neutron target framing.

Operational sequence

Laser/RF pre-ionization → EM compression → metered H^{+}/^{7}Li feed → alpha heat capture → sealed cartridge out → assay/refit.

7. Direct electricity from outgoing alpha particles

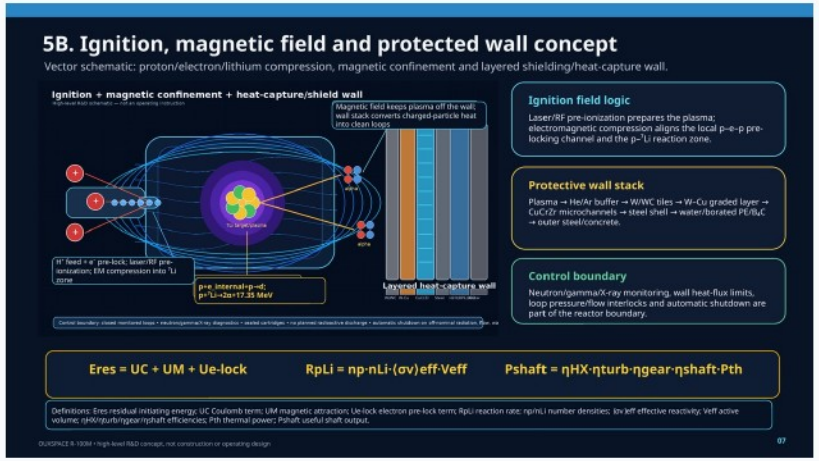
Because alpha particles are charged and leave the reaction zone in many directions, collection must be 4π, segmented and carefully controlled.


Alpha Direct Conversion Geometry — 4π Charged-Particle Capture
neutron/gamma monitoring
Stage 1: high-potential α deceleration collectors
Stage 2: staged electrostatic energy recovery
Residual α heat-stop wall
p + 7Li → 2α + 17.35 MeV
MV staged DC extraction
isolated DC/DC
ship bus / auxiliary bus
α + 2e⁻ → He
sealed He ash handling
W/WC
W–Cu
CuCrZr heat loop
turbine / heat exchanger
collector-potential control
CALCULATION SUMMARY
Per α: Eα ≈ 8.675 MeV, qα = +2e
Equivalent full stopping voltage: Vα ≈ 4.34 MV
250 MWth case: RpLi ≈ 9.0×10^19 s^-1; Iα ≈ 58 A
Direct conversion is staged; not one exposed MV bus.
Concept diagram only — direct conversion is a staged R&D upgrade after thermal-capture validation.

- Per alpha: Eα ≈ 8.675 MeV, qα = +2e.
- Energy-equivalent full stopping voltage: Vα ≈ 4.34 MV.
- At 250 MWth: RpLi ≈ 9.0×10^19 s^-1 and gross alpha charge current Iα ≈ 58 A.
- Therefore direct extraction cannot be one exposed MV bus; it must be staged, insulated and interlocked.
- Baseline demonstrator remains thermal capture; direct DC is the staged R&D upgrade.

8. Protective tiles and complete thermal energy capture

At the bottom of the reactor chain, the protective wall is simultaneously a heat-stop, collector, sensor surface and first heat-exchanger interface.


5B. Ignition, magnetic field and protected wall concept
Vector schematic: proton/electron/lithium compression, magnetic confinement and layered shielding/heat-capture wall.
Ignition + magnetic confinement + heat-capture/shield wall
Magnetic field keeps plasma off the wall; wall stack converts charged-particle heat into clean loops
H⁺ feed + e⁻ pre-lock; laser/RF pre-ionization; EM compression into ⁷Li zone
p+e⁻ internal→p→d; p+⁷Li→2α+17.35 MeV
Layered heat-capture wall
Ignition field logic
Laser/RF pre-ionization prepares the plasma; electromagnetic compression aligns the local p–e⁻–p pre-locking channel and the p–⁷Li reaction zone.
Protective wall stack
Plasma → He/Ar buffer → W/WC tiles → W–Cu graded layer → CuCrZr microchannels → steel shell → water/borated PE/B₄C → outer steel/concrete.
Control boundary
Neutron/gamma/X-ray monitoring, wall heat-flux limits, loop pressure/flow interlocks and automatic shutdown are part of the reactor boundary.
Eres = UC + UM + Ue-lock
RpLi = np·nLi·⟨σv⟩eff·Veff
Pshaft = ηHX·ηturb·ηgear·ηshaft·Pth
Definitions: Eres residual initiating energy; UC Coulomb term; UM magnetic attraction; Ue-lock electron pre-lock term; RpLi reaction rate; np/nLi number densities; ⟨σv⟩eff effective reactivity; Veff active volume; ηHX/ηturb/ηgear/ηshaft efficiencies; Pth thermal power; Pshaft useful shaft output.
OUXSPACE R-100M • high-level R&D concept, not construction or operating design
07

1. W/WC face

Plasma-facing high-temperature protective tile layer; designed for local alpha stopping and heat-flux durability.

2. W–Cu grade

Thermal expansion and heat-spreading transition between hard face and coolant structure.

3. CuCrZr channels

Microchannel heat sink carries the heat into a sealed primary loop.

4. Heat loops

Primary loop remains isolated from seawater by clean intermediate and tertiary heat-exchanger barriers.

5. Turbine use

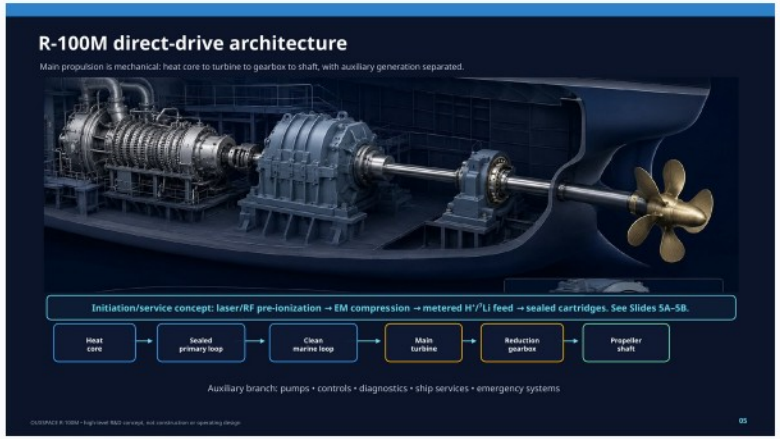
Captured heat is the main baseline energy path to turbine, gearbox and shaft.

6. Sensors

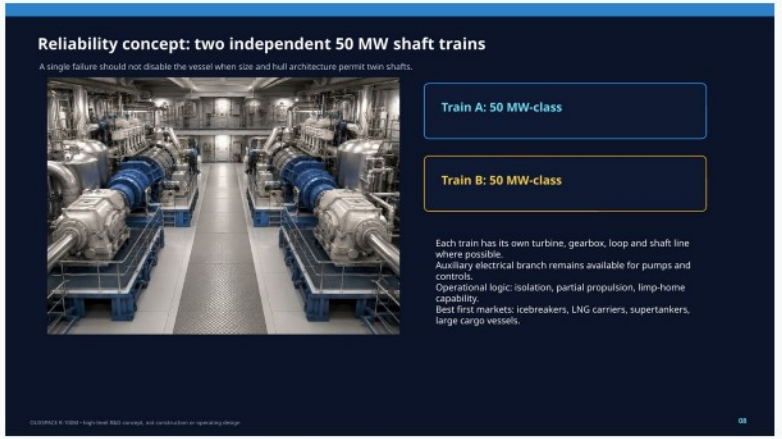
Potential, leakage, heat flux, neutron/gamma and pressure interlocks.

9. Thermal / mechanical output path to propulsion

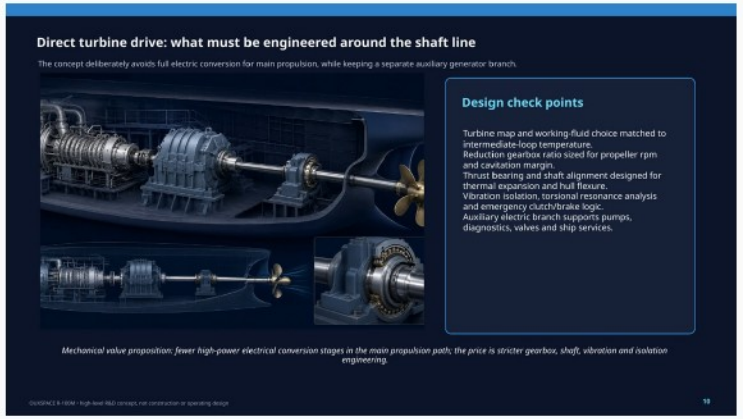
The baseline ship propulsion route deliberately avoids full electric conversion for main shaft power.


R-100M direct-drive architecture
Main propulsion is mechanical: heat core to turbine to gearbox to shaft, with auxiliary generation separated.
Initiation/service concept: laser/RF pre-ionization → EM compression → metered H⁺/⁷Li feed → sealed cartridges. See Slides 5A–5B.
Heat core
Sealed primary loop
Clean marine loop
Main turbine
Reduction gearbox
Propeller shaft
Auxiliary branch: pumps • controls • diagnostics • ship services • emergency systems

Direct-drive architecture


Reliability concept: two independent 50 MW shaft trains
A single failure should not disable the vessel when size and hull architecture permit twin shafts.
Train A: 50 MW-class
Train B: 50 MW-class
Each train has its own turbine, gearbox, loop and shaft line where possible.
Auxiliary electrical branch remains available for pumps and controls.
Operational logic: isolation, partial propulsion, limp-home capability.
Best first markets: icebreakers, LNG carriers, supertankers, large cargo vessels.

Two independent 50 MW shaft trains

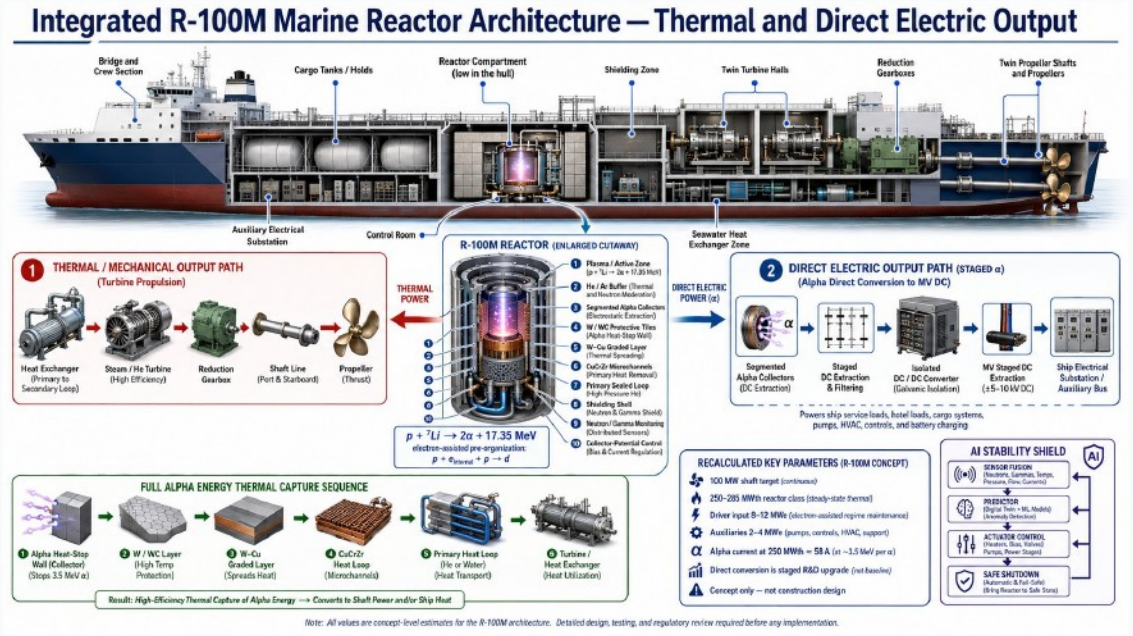

Direct turbine drive: what must be engineered around the shaft line
The concept deliberately avoids full electric conversion for main propulsion, while keeping a separate auxiliary generator branch.
Design check points
Turbine map and working-fluid choice matched to intermediate-loop temperature.
Reduction gearbox ratio sized for propeller rpm and cavitation margin.
Thrust bearing and shaft alignment designed for thermal expansion and hull flexure.
Vibration isolation, torsional resonance analysis and emergency clutch/brake logic.
Auxiliary electric branch supports pumps, diagnostics, valves and ship services.
Mechanical value proposition: fewer high-power electrical conversion stages in the main propulsion path; the price is stricter gearbox, shaft, vibration and isolation engineering.

Shaft-line engineering requirements

- Thermal path: core → sealed primary loop → double-wall heat exchanger → turbine working-fluid system → turbine → gearbox → propeller shaft.
- Reliability path: two independent 50 MW trains allow isolation, partial propulsion and limp-home capability where hull architecture permits twin shafts.
- Engineering watchpoints: turbine map, working fluid, gearbox ratio, thrust bearing, thermal expansion, hull flexure, torsional resonance and emergency clutch/brake logic.

10. Direct electric output path and ship electrical substation

The electric branch is secondary in the first demonstrator and becomes stronger only if staged alpha conversion is experimentally stable.


Integrated R-100M Marine Reactor Architecture — Thermal and Direct Electric Output
Bridge and Crew Section
Cargo Tanks / Holds
Reactor Compartment (low in the hull)
Shielding Zone
Twin Turbine Halls
Reduction Gearboxes
Twin Propeller Shafts and Propellers
Auxiliary Electrical Substation
Control Room
Seawater Heat Exchanger Zone
1 THERMAL / MECHANICAL OUTPUT PATH (Turbine Propulsion)
Heat Exchanger (Primary to Secondary Loop)
Steam / He Turbine (High Efficiency)
Reduction Gearbox
Shaft Line (Port & Starboard)
Propeller (Thrust)
THERMAL POWER
R-100M REACTOR (ENLARGED CUTAWAY)
Plasma / Active Zone
He / Ar Buffer (Thermal and Neutron Moderation)
Segmented Alpha Collectors (Electrostatic Extraction)
W / WC Protective Tiles (Alpha Heat-Stop Wall)
W–Cu Graded Layer (Thermal Spreading)
CuCrZr Microchannels (Primary Heat Removal)
Primary Sealed Loop (High-Pressure He)
Shielding Shell (Neutron & Gamma Shield)
Neutron / Gamma Monitoring (Over-Isolated Sensors)
Collector-Potential Control (Bias & Current Regulation)
p + 7Li → 2α + 17.35 MeV
electron-assisted pre-organization:
p + e⁻assisted → p → d
DIRECT ELECTRIC POWER (α)
2 DIRECT ELECTRIC OUTPUT PATH (STAGED α) (Alpha Direct Conversion to MV DC)
Segmented Alpha Collectors (DC Extraction)
Staged DC Extraction & Filtering
Isolated DC / DC Converter (Galvanic Isolation)
MV Staged DC Extraction (±5–10 kV DC)
Ship Electrical Substation / Auxiliary Bus
Powers ship service loads, hotel loads, cargo systems, pumps, HVAC, controls, and battery charging
FULL ALPHA ENERGY THERMAL CAPTURE SEQUENCE
1 Alpha Heat-Stop Wall (Collector) (Stops 3.5 MeV α)
2 W / WC Layer (High Temp Protection)
3 W–Cu Graded Layer (Spreads Heat)
4 CuCrZr Heat Loop (Microchannels)
5 Primary Heat Loop (He or Water) (Heat Transport)
6 Turbine / Heat Exchanger (Heat Utilization)
Result: High-Efficiency Thermal Capture of Alpha Energy → Converts to Shaft Power and/or Ship Heat
RECALCULATED KEY PARAMETERS (R-100M CONCEPT)
100 MW shaft target (continuous)
250–285 MWth reactor class (steady-state thermal)
Driver input 8–12 MWe (electron-assisted regime maintenance)
Auxiliaries 2–4 MWe (pumps, controls, HVAC, support)
Alpha current at 250 MWth ≈ 58 A (at ~3.5 MeV per α)
Direct conversion is staged R&D upgrade (net-baseline)
Concept only — not construction design
AI STABILITY SHIELD
SENSOR FUSION (Neutrons, Gammas, Ions, Pressure, Flow, Currents)
PREDICTOR (Digital Twin + ML Models) (Anomaly Detection)
ACTUATOR CONTROL (Heaters, Bias, Valves) Pumps, Power Stages)
SAFE SHUTDOWN (Automatic & Fail-Safe) (Bring Reactor to Safe State)
Note: All values are concept-level estimates for the R-100M architecture. Detailed design, testing, and regulatory review required before any implementation.

Segmented collectors

Alpha collectors are held at controlled potentials; floating walls are not allowed.

Staged MV DC

Alpha energy requires staged electrostatic deceleration, not a single exposed high-voltage bus.

Isolated conversion

DC/DC stages galvanically isolate the reactor boundary from the ship auxiliary bus.

Ship substation

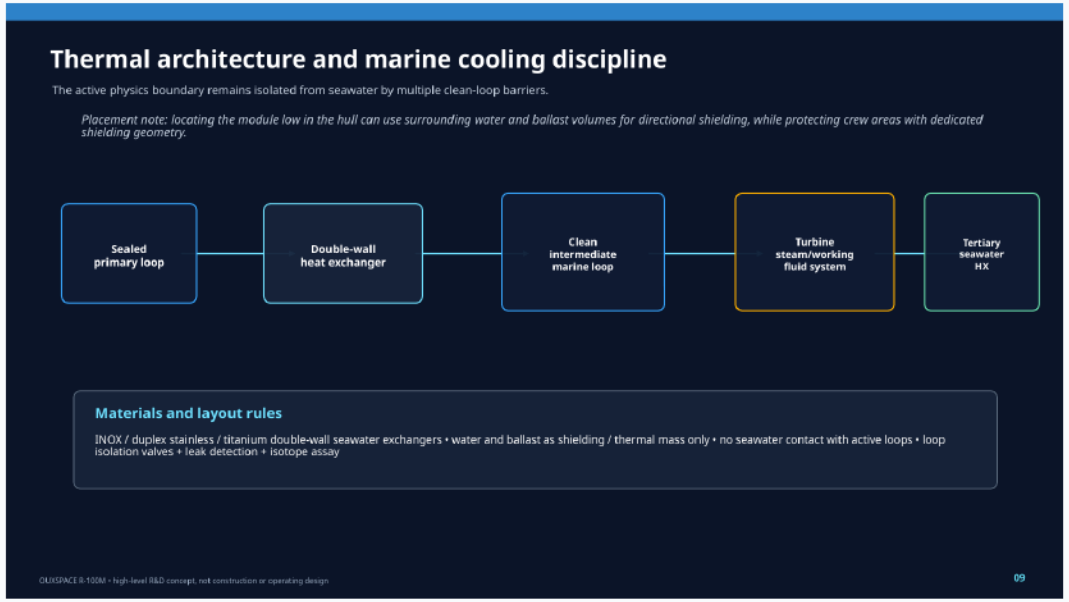
Auxiliary loads: pumps, HVAC, hotel loads, cargo systems, controls and battery charging.

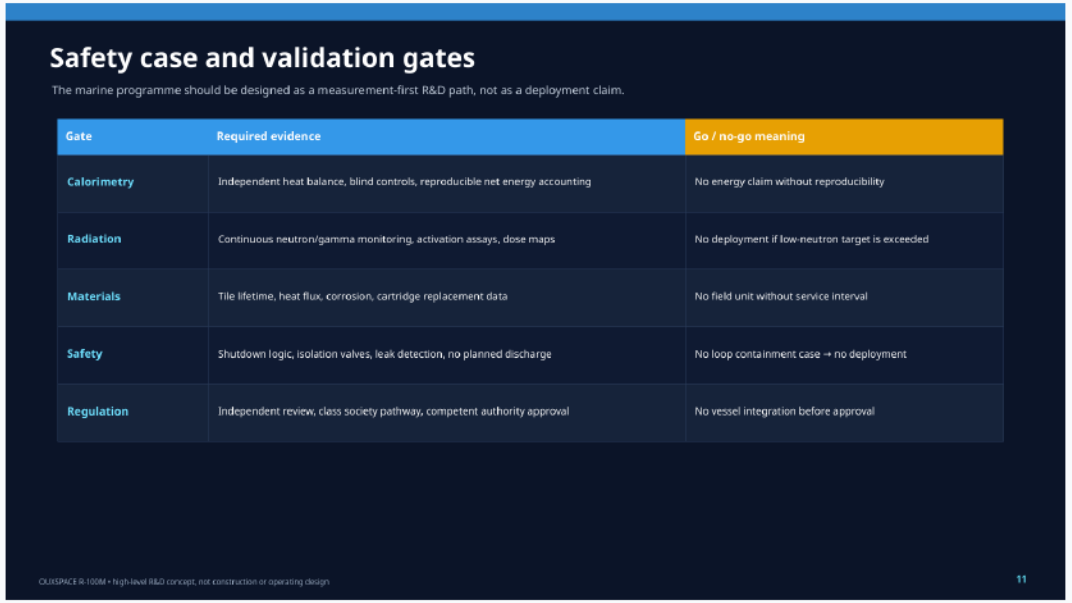
Interlocks

Leakage, arc, potential, heat-flux and radiation signals trigger correction or shutdown.

11. Marine cooling, shielding and loop isolation

The active physics boundary is isolated from seawater by multiple clean-loop and assay barriers.

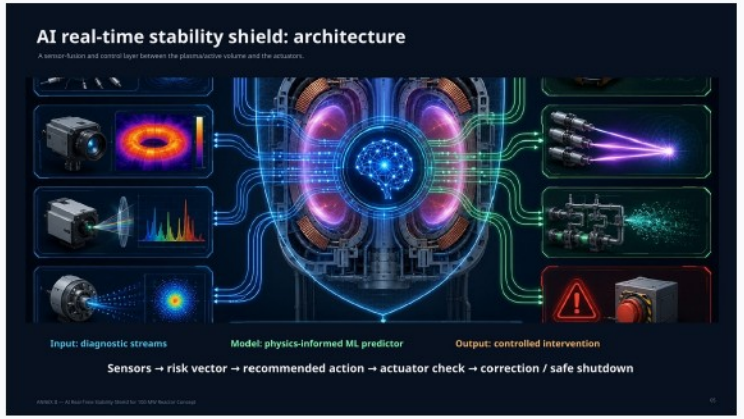

Thermal architecture and marine cooling discipline
The active physics boundary remains isolated from seawater by multiple clean-loop barriers.
Placement note: locating the module low in the hull can use surrounding water and ballast volumes for directional shielding, while protecting crew areas with dedicated shielding geometry.
Sealed primary loop
Double-wall heat exchanger
Clean intermediate marine loop
Turbine steam/working fluid system
Tertiary seawater HX
Materials and layout rules
INOX / duplex stainless / titanium double-wall seawater exchangers • water and ballast as shielding / thermal mass only • no seawater contact with active loops • loop isolation valves + leak detection + isotope assay
OUXSPACE R-100M • high-level R&D concept, not construction or operating design
09

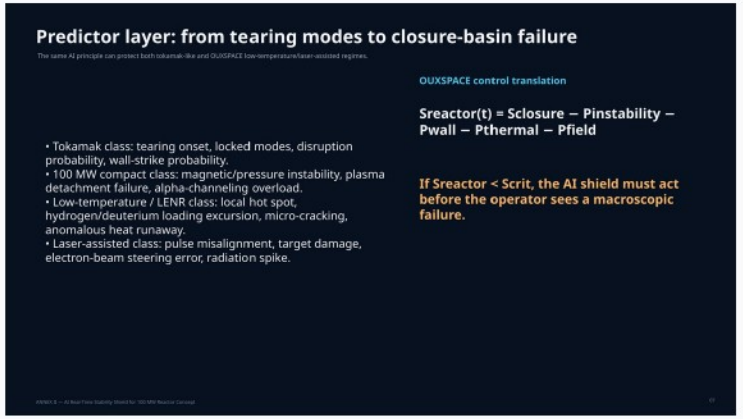

Safety case and validation gates
The marine programme should be designed as a measurement-first R&D path, not as a deployment claim.
Gate
Required evidence
Go / no-go meaning
Calorimetry
Independent heat balance, blind controls, reproducible net energy accounting
No energy claim without reproducibility
Radiation
Continuous neutron/gamma monitoring, activation assays, dose maps
No deployment if low-neutron target is exceeded
Materials
Tile lifetime, heat flux, corrosion, cartridge replacement data
No field unit without service interval
Safety
Shutdown logic, isolation valves, leak detection, no planned discharge
No loop containment case → no deployment
Regulation
Independent review, class society pathway, competent authority approval
No vessel integration before approval
OUXSPACE R-100M • high-level R&D concept, not construction or operating design
11

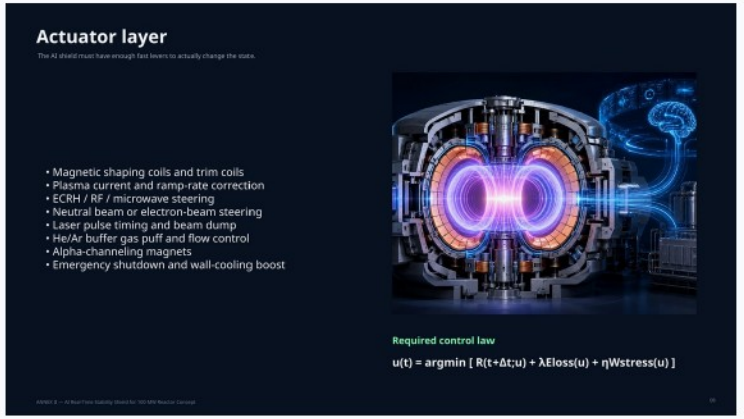
- Loop hierarchy: sealed primary loop → double-wall heat exchanger → clean intermediate marine loop → turbine system → tertiary seawater heat exchanger.
- No seawater contact with active loops; use isolation valves, leak detection and isotope assay.
- Shielding stack combines steel, water, borated PE / B4C and geometry; ballast/water can help directional shielding if the module is low in the hull.

12. AI real-time stability shield and deterministic safety kernel

The reactor is framed as a controlled cyber-physical plant, not a passive heat source.


AI real-time stability shield: architecture
A sensor-fusion and control layer between the plasma/active volume and the actuators.
Input: diagnostic streams
Model: physics-informed ML predictor
Output: controlled intervention
Sensors → risk vector → recommended action → actuator check → correction / safe shutdown


Predictor layer: from tearing modes to closure-basin failure
The same AI principle can protect both tokamak-like and OUXSPACE low-temperature/laser-assisted regimes.
• Tokamak class: tearing onset, locked modes, disruption probability, wall-strike probability.
• 100 MW compact class: magnetic/pressure instability, plasma detachment failure, alpha-channeling overload.
• Low-temperature / LENR class: local hot spot, hydrogen/deuterium loading excursion, micro-cracking, anomalous heat runaway.
• Laser-assisted class: pulse misalignment, target damage, electron-beam steering error, radiation spike.
OUXSPACE control translation
Sreactor(t) = Sclosure − Pinstability − Pwall − Pthermal − Pfield
If Sreactor < Scrit, the AI shield must act before the operator sees a macroscopic failure.


Actuator layer
The AI shield must have enough fast levers to actually change the state.
• Magnetic shaping coils and trim coils
• Plasma current and ramp-rate correction
• ECRH / RF / microwave steering
• Neutral beam or electron-beam steering
• Laser pulse timing and beam dump
• He/Ar buffer gas puff and flow control
• Alpha-channeling magnets
• Emergency shutdown and wall-cooling boost
Required control law
u(t) = argmin [R(t+Δt;u) + λEloss(u) + ηWstress(u)]

Sensor fusion

Magnetic probes, soft X-ray/ECE class diagnostics, wall thermal cameras, neutron/gamma monitors and loop pressure/flow sensors.

Predictor + control

Risk vector R(t) estimates collapse, wall-strike, hot spot, runaway, field loss and abnormal radiation before macroscopic failure.

Safety kernel

Every AI recommendation is blocked or authorized by deterministic limits; safe shutdown overrides optimization.

13. Recalculated parameters — consistent system view

Updated values used in the integrated deck; all are concept-level envelopes requiring validation.

Power basis

Useful shaft target: 100 MW total. Preferred redundancy: 2 × 50 MW independent trains. Reactor class: 250–285 MWth. Chain efficiency: 35–40%.

Driver and auxiliaries

Driver/RF/laser/compression input: 8–12 MWe. Auxiliaries: 2–4 MWe. Thermal gain Pth/Pdriver: 20–30; representative value ≈25.

Alpha electric

Per alpha: 8.675 MeV. Full stopping voltage equivalent: 4.34 MV. At 250 MWth: Iα ≈ 58 A. Direct conversion is staged R&D.

Fuel / ash

For 200 operating days: Li-7 burned ~18–21 kg and H/protons ~2.6–3.0 kg at 250–285 MWth; main ash He-4.

Mass envelope

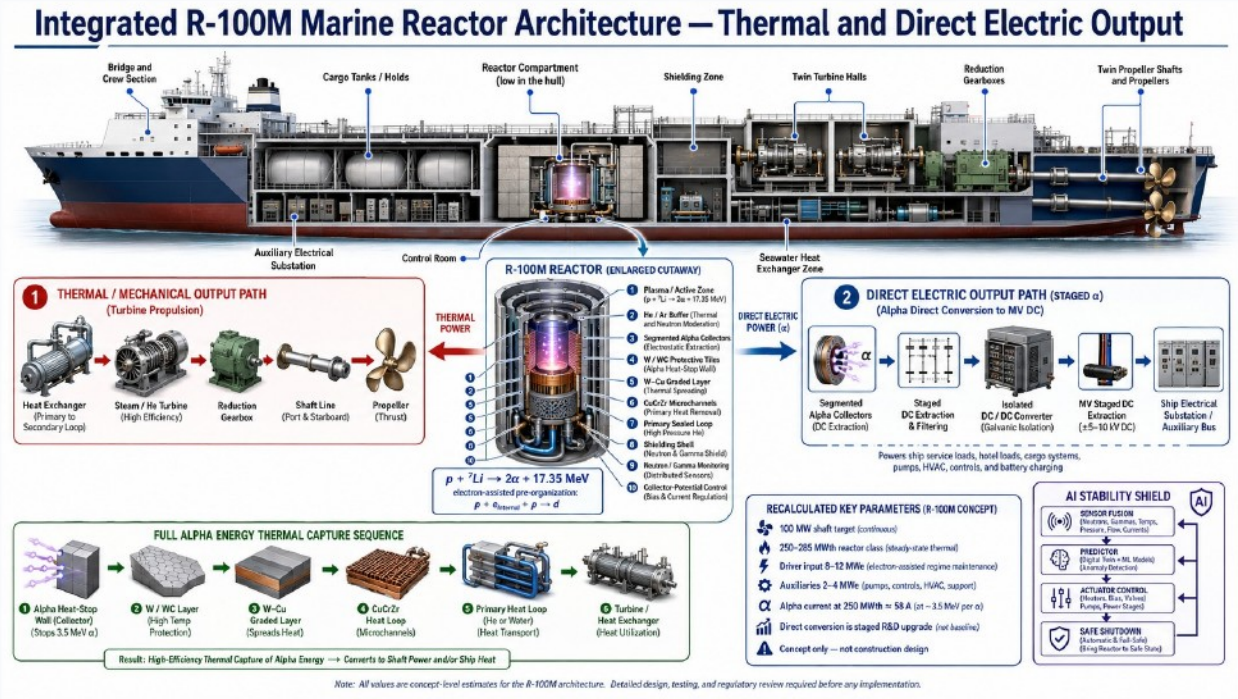
The reactor-island central estimate excluding turbines and propulsion equipment remains about 850–900 tonnes, with first R&D marine module wording around 700–1,100 tonnes. This figure includes magnets, loops, heat exchangers, shielding, support structures and controls.

Design boundary

Direct electric alpha conversion does not replace heat capture in the first demonstrator. The first validated path remains thermal capture + charge drainage + clean loops + turbine drive.

14. Final integrated visual summary and source coverage

This slide preserves the previous integrated v2 deck as a visual gallery and repeats the final complete reactor-output schematic.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Auxiliary Electrical Substation
Control Room
Seawater Heat Exchanger Zone
1 THERMAL / MECHANICAL OUTPUT PATH
(Turbine Propulsion)
Heat Exchanger (Primary to Secondary Loop)
Steam / He Turbine (High Efficiency)
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Shaft Line (Port & Starboard)
Propeller (Thrust)
THERMAL POWER
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DIRECT ELECTRIC POWER (α)
2 DIRECT ELECTRIC OUTPUT PATH (STAGED α)
(Alpha Direct Conversion to MV DC)
Segmented Alpha Collectors (DC Extraction)
Staged DC Extraction & Filtering
Isolated DC / DC Converter (Galvanic Isolation)
MV Staged DC Extraction (±5–10 kV DC)
Ship Electrical Substation / Auxiliary Bus
Powers ship service loads, hotel loads, cargo systems, pumps, HVAC, controls, and battery charging
p + 7Li → 2α + 17.35 MeV
electron-assisted pre-organization:
p + e(external) + p → d
FULL ALPHA ENERGY THERMAL CAPTURE SEQUENCE
1 Alpha Heat-Stop Wall (Collector) (Stops 3.5 MeV α)
2 W / WC Layer (High Temp Protection)
3 W-Cu Graded Layer (Spreads Heat)
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Result: High-Efficiency Thermal Capture of Alpha Energy → Converts to Shaft Power and/or Ship Heat
RECALCULATED KEY PARAMETERS (R-100M CONCEPT)
100 MW shaft target (continuous)
250–285 MWth reactor class (steady-state thermal)
Driver input 8–12 MWe (electron-assisted regime maintenance)
Auxiliaries 2–4 MWe (pumps, controls, HVAC, support)
Alpha current at 250 MWth ≈ 58 A (at ~3.5 MeV per α)
Direct conversion is staged R&D upgrade (not baseline)
Concept only — not construction design
AI STABILITY SHIELD
SENSOR FUSION
PREDICTOR
ACTUATOR CONTROL
SAFE SHUTDOWN
Note: All values are concept-level estimates for the R-100M architecture. Detailed design, testing, and regulatory review required before any implementation.

- The source galleries in Slides 2–5 preserve the visual content of the previous decks.
- The final schematic links the whole ship, reactor compartment, thermal/mechanical shaft path, direct-electric branch and auxiliary substation.
- Next v4 step: separate large full-slide drawings for the ship cutaway, reactor cutaway, alpha-electric branch and thermal-tile stack.

PART II

Pulsed Direct-Recovery + 6D Schrödinger / I-Z / TERRA SPACE Extension

The following slides preserve the complete v5 deck, including the 6D / I-Z / TERRA SPACE feasibility formula page.

OUXSPACE R-100M / R-1M

Pulsed Direct-Recovery Marine Reactor Concept

ResearchGate presentation v4 - Helion-inspired lessons for shuttle-FRC / magneto-inductive recovery, integrated with alpha thermal capture and marine safety boundaries

Baseline stays conservative:
alpha heat capture -> sealed loops -> turbine -> shaft

R&D upgrade:
plasma expansion -> recovery coils -> isolated DC bus

Safety boundary:
low-neutron target, not zero-radiation; no construction details

Prepared for publication as a high-level R&D architecture note. No active fuel procedure, no ignition recipe, no build drawings.

What is new in v4

From alpha thermal/direct DC to pulsed magneto-inductive recovery

Existing v3F foundation

- p + 7Li -> 2 alpha + 17.35 MeV as useful charged-particle branch
- Baseline heat capture through W/WC, W-Cu and CuCrZr wall stack
- Turbine shaft propulsion plus auxiliary ship substation
- AI stability shield with deterministic safety kernel

New v4 option

- Pulsed shuttle-FRC-like plasmoid formation and collision
- Central compression/recovery cell instead of steady wall exposure
- Direct magnetic recovery from expanding plasma into coils
- Reduced wall heat fraction if recovery is experimentally stable

Claim discipline

- Architecture lesson only; no Helion affiliation or parameter copy
- Thermal route remains first demonstrator
- Direct recovery is staged R&D after non-active pulsed rig validation
- Safety gates override performance optimization

Reference architecture: v3F integrated marine plant

High-level R&D concept already combines heat, DC, AI and marine output

Reaction branch		Thermal capture		Power island		Electric branch
p + 7Li -> 2 alpha 17.35 MeV	→	W/WC face W-Cu grade CuCrZr channels	→	sealed loops turbines gearboxes twin shafts	+	segmented collectors isolated DC/DC ship substation

v3F already states: low-neutron target, not zero-radiation; all nuclear claims require calorimetry, radiation validation and activation assays.

Pulsed direct recovery: principle

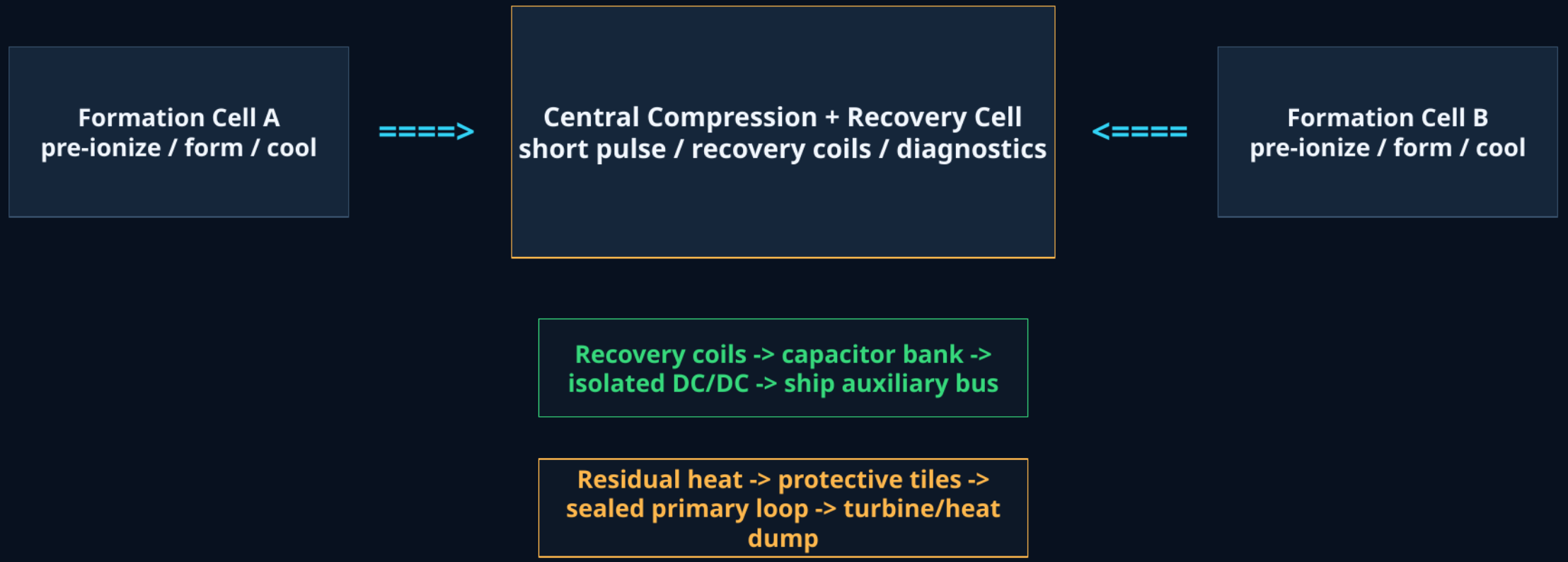
A second direct-electric path, separate from electrostatic alpha collection

1. Formation	2. Acceleration	3. Compression	4. Recovery	5. Reset
Two magnetized plasma packets are created in end cells.	Plasmoids are moved axially toward a central recovery cell.	Pulsed magnetic fields compress the merged FRC-like plasma.	Expansion pushes magnetic flux; coils return energy to capacitors.	Dump, cool, diagnose, restart.

Design lesson: use pulses and magnetic recovery to reduce continuous wall heat flux; do not claim steady-state yacht reactor operation before shore proof.

Shuttle-FRC module concept

Conceptual layout for a pulsed marine direct-recovery option



No electrode-in-plasma current collection. The electric branch is induction from changing magnetic flux, not direct plasma contact.

Three energy paths in the integrated plant

Baseline first, direct-electric branches only after staged validation

A. Thermal / mechanical baseline	B. Alpha electrostatic DC	C. Magneto-inductive recovery
charged particles stopped in wall heat to sealed primary loop turbine -> gearbox -> shaft	segmented high-voltage collectors staged deceleration isolated DC/DC	plasma expansion pushes B-field induced current in coils capacitor/DC bus
First validated route	**R&D upgrade 1**	**R&D upgrade 2**

The v4 thesis: combine a conservative thermal baseline with two staged direct-electric pathways, while treating pulsed recovery as an experimental option.

Why pulsed operation may help the marine wall problem

High heat flux is the central compact-reactor challenge

Steady hot volume	Pulsed shuttle volume	Engineering implication
continuous wall exposure large thermal gradients heavy cooling loop large heat exchanger burden	formation cells reset central pulse is short wall sees duty-cycle load recovery coils take part of energy	thermal capture still required but cooling can be sized with measured recovery fraction and hard pulse limits

The target is not to remove shielding or cooling. The target is to shift some useful energy from wall heat into controlled electromagnetic recovery.

Direct alpha DC vs magnetic recovery

Two direct-electric mechanisms with different hazards

Alpha electrostatic conversion

- Charged alpha particles are decelerated by staged collectors.
- MV-class insulation, leakage, arcing and neutralization are boundary variables.
- Best used after thermal stopping and charge-drainage demonstrators.

Magneto-inductive recovery

- Whole plasma expansion changes magnetic flux through recovery coils.
- Capacitor banks and pulsed coils carry the direct electrical energy.
- Main hazards are overvoltage, coil stress and asymmetric plasmoid shots.

Common principle: no floating reactor wall and no single exposed high-voltage bus. Every direct-electric path must be segmented, isolated, instrumented and interlocked.

Lithium architecture for a publishable concept

The cartridge may contain mission mass, but active-zone accessible mass must be mechanically tiny

Forbidden

- Loose Li pellets or hopper near the reaction volume
- Bulk reservoir -> pipe -> active zone
- Gravity feed, siphon path or software-only metering
- Refill or open-cartridge handling at sea

Allowed R&D framing

- Pre-sealed segmented cartridge
- Segmented micro-inventory exposure
- Normally closed mechanical barriers
- Shore-only replacement, assay and refurbishment

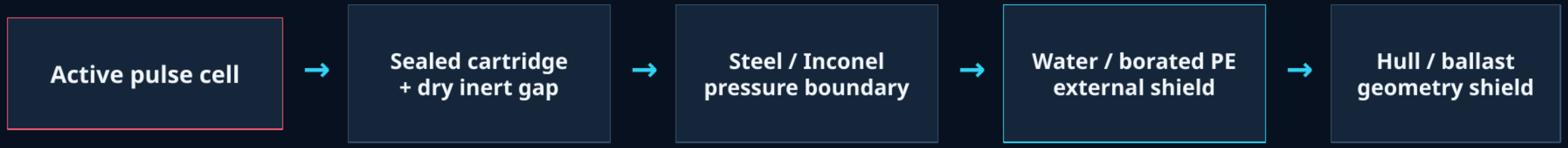
Safety claim

- Total Li logistics can be kilograms over a mission
- But credible fault access must be far below gram-scale
- No single or double fault may connect Li, H2, water and active plasma
- Water shielding only outside dry containment

Publication language: "sealed segmented lithium-bearing cartridge" - not "lithium feed system".

Marine containment and shielding stack

Water helps shielding only after dry metal boundaries; it must never be the lithium barrier


Active pulse cell
Sealed cartridge + dry inert gap
Steel / Inconel pressure boundary
Water / borated PE external shield
Hull / ballast geometry shield

Key rule: water may be a shield and heat sink, but not an internal quench barrier adjacent to lithium. A dry, leak-detected metal boundary must come first.

New hazards introduced by pulsed direct recovery

A useful recovery path creates a new electrical and dynamic safety case

Electrical hazards

- capacitor-bank overvoltage
- coil overcurrent / insulation failure
- arc or leakage to hull
- DC/DC isolation fault

Plasma dynamics hazards

- asymmetric plasmoid formation
- mis-timed collision or compression
- wall-strike pulse
- magnetic pressure shock

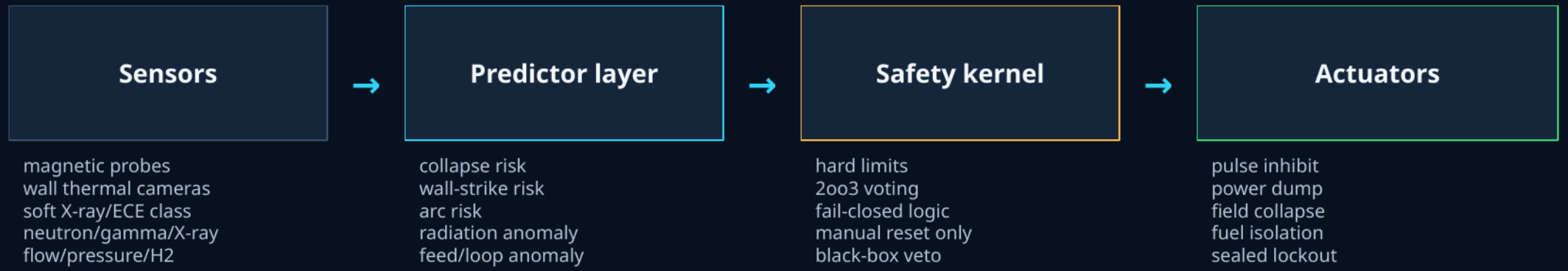
Nuclear/radiation hazards

- unknown branch or impurity channel
- gamma / X-ray / neutron spike
- activation of wall stack
- post-shot dose or heat retention

Safety posture: direct recovery may reduce wall heat, but it cannot be credited as the primary accident barrier.

Deterministic safety kernel around AI control

AI predicts; the hard kernel authorizes or blocks



Rule: no pulse unless both plasmoid packets, recovery coils, cooling loops, radiation monitors and containment states pass independent pre-shot checks.

Validation pathway for ResearchGate publication

A publication concept should show how the idea can fail safely before nuclear operation

Phase 0
Desktop safety model

→

Phase 1
Non-active pulsed EM dummy rig

→

Phase 2
Shielded-cell plasma recovery test

→

Phase 3
Low-power shore prototype

→

Phase 4
Marine inert integration

Go/no-go gates

- calorimetry closure
- neutron/gamma/X-ray spectra
- activation assay
- recovery-coil stress test
- hard-shutdown proof

ResearchGate claim

This is a publishable architecture and safety roadmap, not a certified marine reactor design.

Final marine step

Active yacht/small-ship operation only after class, regulator and insurance pathway.

Conceptual system envelope

Numbers are v3F concept envelopes, not construction specifications

Power basis

100 MW useful shaft target
2 x 50 MW independent trains
250-285 MWth reactor class
35-40% chain efficiency

Direct-electric branches

Alpha staged DC: R&D
Magnetic recovery: v4 option
Both require isolated DC/DC
Both secondary to thermal baseline

Fuel logistics

Li-7 consumed over mission can be kg-scale
Accessible fault inventory must be micro/mini-segment scale
No bulk Li feed at sea

Mass envelope

R-100M reactor island conceptual envelope: hundreds of tonnes to ~1,000 t class
R-1M yacht version requires separate downscaled shore proof

The v4 addition is not a power claim; it is a path to reduce thermal burden if pulsed magnetic recovery can be experimentally demonstrated.

Recommended v4 additions to the existing deck

Four new slides or sections for a ResearchGate update

16. Pulsed Shuttle-FRC Direct-Recovery Option

Introduce the twin formation cells, central compression/recovery cell, recovery coils and capacitor/DC bus.

17. Direct Alpha DC vs Direct Magnetic Recovery

Clarify electrostatic alpha deceleration versus induction from expanding plasma; both require isolation.

18. Wall-Heat Reduction and Rotating Duty Cycle

Explain why pulsed operation may reduce continuous wall heat flux without eliminating cooling or shielding.

19. New Safety Hazards and Deterministic Shutdown Logic

Add capacitor-bank, coil, wall-strike and asymmetric-shot hazards to the AI/safety kernel architecture.

Publication conclusion

A conservative hybrid message for ResearchGate

Core conclusion

The publishable idea is not a finished yacht reactor. It is a staged marine power-island architecture: thermal baseline plus two direct-electric R&D branches.

Technical thesis

Pulsed shuttle-FRC-like operation may allow plasma energy recovery through coils while lowering average wall heat flux.

Safety thesis

No direct-recovery benefit is credited unless segmentation, dry containment, radiation monitoring and hard shutdown are experimentally proven.

Final statement: R-100M/R-1M should be framed as a high-level R&D roadmap for pulsed, segmented, shielded marine fusion concepts - not as an operating blueprint.

References and source boundary

Source materials used for this v4 ResearchGate presentation

Primary internal source

- OUXSPACE R-100M Integrated Alpha Direct Electric Conversion v3F, uploaded source deck, 15-slide synthesis.

- Existing deck scope: main architecture, alpha direct electricity, thermal capture, AI shield, ship cutaway and substation output.

Public pulsed-FRC / direct-recovery references

- Helion Energy technology page: high-beta FRC, pulsed magnets and direct electricity recovery.

- Helion blog, "More on Helion's pulsed approach to fusion" and public descriptions of plasma expansion inducing current in coils.

- Used only as an architectural analogy; no affiliation, endorsement or parameter copying is claimed.

Claim discipline

- Low-neutron target is not zero-radiation.

- No ignition parameters, active fuel procedures or construction drawings are included.

- All nuclear claims require calorimetry, spectrum logging, activation assays and licensed shore validation.

- The deck is for ResearchGate concept publication and peer discussion.

6D Schrödinger / I/Z / TERRA SPACE feasibility form

High-level theoretical gate for p + 7Li -> 2 alpha + 17.35 MeV; publication framing only - no ignition recipe, no construction parameters.

1. Six-dimensional wave closure

$\Psi_6 = \Psi(x,y,z,\xi,\eta,\zeta,t)$, $\rho^2 = \xi^2+\eta^2+\zeta^2$

$i\hbar\,\partial t\Psi_6 = [-(\hbar^2/2\mu_3)\nabla_3^2 - (\hbar^2/2\mu_\perp)\nabla_\perp^2 + V_C(r) + V_\perp(\rho) + V_{TS}(I/Z,\kappa)]\,\Psi_6$

Extra coordinates represent transverse / membrane / TERRA-space closure modes.

Physical meaning: the branch is allowed only when the 6D packet has overlap in the compact interaction pocket.

2. I/Z barrier and overlap gate

$\eta_{eff}(E,\chi) = \eta_C(E) \cdot [1 - \Lambda_{I/Z}(\chi) - \Lambda_{TS}(\kappa,\rho)]$

$\sigma_6D(E) = S_6D(E)/E \cdot \exp[-2\pi\,\eta_{eff}(E,\chi)]$

$\langle\sigma v\rangle_6D = \int f(E)\,\sigma_6D(E)\,v(E)\,dE$

I/Z logic is treated as a bounded impedance/admittance correction. Experiment must fix Λ and validate the barrier term.

3. Net-energy feasibility criterion

$R_{pLi} = n_p\, n_{7Li}\, \langle\sigma v\rangle_6D$

$P_{gain} = R_{pLi} \cdot Q_\alpha \cdot \varepsilon_{rec}$, $Q_\alpha = 17.35$ MeV

Gate: $P_{gain} > P_{loss} + P_{shield} + P_{control}$

Low-neutron is acceptable only if measured N_n/N_α, spectra and activation assays stay inside licensed boundaries.

ResearchGate claim discipline: these equations form a falsifiable feasibility framework. They do not replace calorimetry, neutron/gamma/X-ray logging, activation assays, shield tests, or licensed shore validation.